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INFORMATION TECHNOLOGICAL REVOLUTION AND INSTITUTIONAL INNOVATIONS

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PREFACE

The history of this working paper is the following. I wrote a small book entitled *National innovation system. Scientific concept or political rhetoric* published by the Finnish Innovation Fund (Sitra) and Edita publisher in 2002. The book emerged from one of the projects of the Sitra Research Program on the Finnish innovation system. The term national innovation system (NIS) became as a foundational term for the Finnish science and technology policy in the early1990s and I wanted to analyze the background of the concept and its uses in the Finnish science and technology policy. In 2006 Yuji Mori of University of Shizuoka suggested me in a conference that the 2002 book be translated into Japanese. This initiative led me to write an updated and enlarged version of the original book. The book entitled *Finnish National Innovation system. From technology to human capabilities*" was published in Japanese in 2010. A new final chapter of the book dealt with the relationship between information technological revolution and organizational and institutional change. In my new book *Innovation human capabilities and democracy. Towards enabling welfare state* (Oxford University Press 2013), this chapter was not included and therefore it has not been available in the English language. This working paper is a slightly revised and updated version of the final chapter of the 2010 book.

1 TECHNOLOGICAL REVOLUTIONS AND INSTITUTIONAL CHANGE

Innovation policy has strongly been oriented to the creation of the conditions of success for a nation in the international economic competition. The adoption of the national innovation system policy in Finland was a part of the transition from the language of a welfare society into the language of a competition society. The innovation policy itself was focused on the creation of competitive centers excellence, regional concentrations of expertise and on directing money and resources to promising new technologies and fields of high-technology production. In this policy frame, not much room has been thus far left for such societal values as environmental sustainability or the advancement of democracy in the society.

In this chapter I will argue, that the advancement of democracy and the encouragement local creativity of the professionals and citizens in all institutions of society is the most important foundation for innovation policy in today's society of well-educated people. Richard Nelson (2007, 31) recently stated that theorizing on the evolutionary growth has "until recently at least, neglected the evolution of business practice, organizational forms and institutions more generally." Carlota Perez's (2002) theory of the structure of technological revolutions is a good starting point for analyzing the relationship between technological change, organizational change and democracy. According to Perez we are living the synergy phase of the information technological revolution that is the period of organizational and institutional innovations. The organizational forms of production must finally undergo a change to allow the full deployment of the new technology. The social and organizational innovations are changes in the ways things are done in various local activities. That is why they call for local initiative and participation.

There is growing agreement in the literature that the traditional forms of organizing economic activity, that is, markets and hierarchies, no longer meet the requirements of innovativeness in the latter period of the information technological revolution. The emerging new form of organization has most often characterized in terms of trust based network, but also the concepts of open innovation (Chesbrough 2003), collaborative community (Adler & Heckscher 2006) and commons-based peer-production (Benkler 2006) have been used. In these, hierarchical forms of control are increasingly replaced by horizontal peer-to-peer collaboration based on reciprocity of knowledge.

The breakthrough of the Internet led to a new form of distributed knowledge production characterized as open source software development exemplified by

Linux and Apache development communities. This model has extended from software production to other forms of knowledge production such as Wikipedia encyclopaedia. Internet-mediated open development model allows thousands of users to contribute to product design and knowledge production. That is why Eric von Hippel (2005) has characterized it as democratization of innovation.

It can be maintained, following the idea of American philosopher John Dewey (1926/1988), that the heart of the democracy is the possibility of the individuals to develop their capabilities. This is possible if practitioners in different spheres of society are able to participate in solving together the problems of their collective activity. The problem solving assumes a form of a local experiment. The agent of an experiment is a 'community of inquiry.' It is composed of managers, practitioners, and different kinds of experts, various stakeholders and researchers. The relationship between the individual and community development is reciprocal: the creative work in communities supplies an environment to maximum individuals development.

Two kinds of institutional conditions for innovation on local level can be indicated: intellectual property rights and forms of governance. Economists have analyzed the potential problems caused by the exclusive uses of the IPRs for knowledge production (e.g. David & Foray 2002, Nelson 2004). On the other hand, the open source community has developed new forms of using intellectual property rights (IPRs) such as General Public License. This license is based on the so-called copy left principle, which ensures free availability of the code in the Internet and gives to the users right to use, transform and further distribute the code. Evidently a transformation of IPR institutions is going on influencing the conditions of innovation.

The forms of governance do influence on innovativeness and the conditions of local experimentation. Management by results was extensively introduced in the Finnish public administration in the 1980s and 1990s. Management by results uses ostensibly well-defined, measurable goals and indicators for controlling the efficiency of activities. Such indicators tend to exclude novel ways of action and are instead oriented in increasing the efficiency of the existing forms of production. These methods of governance, characteristic to the mass industrial paradigm, inhibit innovativeness and initiative at local level. It will argue that the present synergy phase of the information technological revolution calls for forms of governance that allow and support local experimentation and initiative.

2 THE ORGANIZATIONAL CONSEQUENCES OF THE INFORMATION TECHNOLOGICAL REVOLUTION

Carlota Perez's (1983, 2002) theory of technological revolutions and techno-economic paradigms studies the interaction between technological change, economic growth and institutional order in the society. The unit of analysis of this interaction is the technological revolution caused by the breakthrough of a new generic technology "The process of creative destruction occurs then, every 50 or 60 years, both in the economy and in the socio-political framework (2002, 25)." Each revolution gives rise to a "new economy," a new way of organizing the production, patterns of consumption and institutions that regulate economic and social life. This is called a techno-economic or organizational paradigm (2002, 17). Such periods of development used to be called long waves in economic history.[1] Perez (2002, 11) makes a distinction between five successive technological revolutions in the history of industrial capitalism. The fourth revolution, for instance, started in 1908 when the first model T came off the conveyer belt in Ford's Chicago plant. The IT revolution started in 1971 when the Intel microprocessor came onto the market and started to revolutionize the computer and communication technologies.

Perez (2002) supplies an analysis of the four phases of a technological revolution. The first phase, the *irruption* phase, denotes "the love affair" between financial capital and new technological fields: decreasing returns from mature fields causes investments to be redirected to new promising technologies. In the *frenzy* phase "self-sufficient financial capital governs the casino." Financial capital decouples from production and an economic bubble, with overoptimistic expectations related to new areas emerges. It is followed by the turning point in the form of an after-frenzy recession. In the ICT revolution it was the implosion of NASDAQ bubble in April 2000. In the *synergy* phase, real growth of production returns as the basic source of wealth. This is also the period of institutional and organizational innovations. It is followed by the *maturity* phase in which market saturation of main industries already paves the way for the next surge.

The development of the revolution during the cycle is realized unevenly. The technological changes driven by competitive pressures proceed while the institu-

[1] Cristopher Freeman's and Francisco Louçã's *As time goes by. From industrial revolution to information revolution* (2001) supplies a summary of the research tradition of waves in economic development and its connection to the idea of techno-economic paradigms by evolutionary economics.

tional changes have stronger inertia and lag behind. The institutional reforms required by the utilization of the new technology take place after a time lag or, as suggested by Perez, toward the end of the surge after the turning point caused by a slump (2002, 17): “Eventually the socio-institutional framework will accommodate and enable the full deployment of the technological revolution.”

In comparison with structural approaches of innovations, Perez’s model is a hypothesis of the nature of the interaction between technological, economical, social and organizational regimes of society (Fagerberg 2003, 140). In addition, it frames this interaction chronologically in a way that is relevant for policy making: each phase of a revolution typically lasts 15 years or so. It takes the dynamic nature of capitalism into account and reminds us that any period should not regarded a permanent or final. It “helps to see ahead to next phase of the sequence, in order to design timely actions to make the best of impending opportunities” (Perez 2002, 7).[2]

Perez’s model seems to account very well for the early phases of the information technology revolution, especially by noting the mismatch between the technological and the organisational regimes. Several studies show that the implementation of information technology in the hierarchical organizations of the mass production paradigm hindered the deployment of the potential of the new technology. Zuboff (1988) studied the adoption of computers in a bank, an insurance company and an industrial firm in the 1980s. She showed that the hierarchical power structures undermined the possibilities of utilizing the new technology effectively. Economists have analyzed the reasons for the so-called productivity paradox, formulated polemically by Robert Solow as follows (1987, 36): ”We see computers everywhere but in the productivity statistics.” Lundvall and his colleagues studied the decrease of productivity in Danish industry in 1984-1986 and found that it was related to the way in which the information technology was implemented (Lundvall 2004, 2): “We found that firms that introduced IT without combining it with investments in training with employees, with change in management and with change in work organization got a negative effect on productivity growth that lasted several years.”

The same has been observed in public administration. Dunleavy & al. think that “yet the waves of IT change that occurred before the late 1990s has very limited transformative impacts. (…) Agencies became highly dependent on their

[2] Perez thinks (2002, 166) that those who “grasp the sense of the times, correctly interpret the potential and the direction of change and deeply understand the characteristics of the relevant paradigm, are more likely be able to pursue their goals with viable and realistic proposals.” I use Perez’s model first of all as a [sociological] hypothesis for analyzing the relationships between technological and social-institutional change. For that purpose there is no need to ask whether the phenomenon of long cycles in economic development is empirically tenable (for a discussion, see e.g. Fagerberg 2002) or how valuable the phenomenon of coupling and decoupling financial and production capital is in explaining the economic cycles.

IT structures, but this did not shape their mode of operating as much as might have expected" (Dunleavy & al. 2005, 478). The current period of the growth of the Internet, E-mail, and the web and the generalization of IT systems makes more radical changes necessary in the relationships between government agencies and civil society. The emergent "digital-era governance" will be characterized by the integration of public services to meet the needs of the clients and digitalization of services (ibid. 480): "Instead of electronic channels being seen as supplementary to conventional administrative and business processes, they become genuinely transformative, moving toward a situation where the agency "*becomes* its Wed site," as a senior office in the Australian Tax Office described this process for us."

In the ongoing synergy phase of the IT revolution, organizational and institutional transformations allow the full deployment of the new technology. During this phase the mismatch between technological and organizational/institutional regimes is removed and a new paradigm emerges. According to Perez (2002, 52) the synergy phase constitutes "a space for social rethinking and reconsidering."[3] The changing focus of innovation policy discourse from technical innovation to social innovations becomes understandable in the light of Perez's model: during the synergy phase it is recognized that the possibilities of technology cannot genuinely be utilized without changes in the ways the production is organized.

The social turn in Finland's innovation policy took place in the early 2000s. In its 2003 review, the Science and Technology Policy Council of Finland identified the development of "social innovation activity" as a major challenge for the Finnish innovation system (p. 22). The final report of the project *Social innovations and the society's capacity for renewal* (Hämäläinen & Heiskala 2004, 10) defines social innovations as "reforms related to regulation, politics, organizational structures and models of action that improve the performance of society." In 2007 the ministry of Trade and Industry of Finland adopted an enlarged concept of innovation and innovation policy. According to it, innovation is "a *utilized* [either commercially or from the point of welfare of citizens R.M.] *know-how-based advantage of competition*.[4]

[3] Perez characterizes the political changes during the ICT revolution as follows (2002, 146): "The process of creative destruction taking place in the economy was accompanied by the demolition of the old edifice of state intervention and regulation, which have stopped being effective in that specific form. In the frenzy phase, the reign of market fundamentalism was supreme (…). The recession that follows the collapse of the bubble once again creates conditions for the emergence of new economics and new policies. (…) The nature of new economics and of the tools that it provides for government action (…) will have enormous bearing on the direction given to the potential of this technological revolution." She finds that the present period (p. 167) "is a time for institutional imagination."

[4] Powerpoint presentation in a meeting in the Ministry of Trade and Industry 3 December 2007.

The features of the synergy phase can be recognized in these definitions of social innovation policy. First, they recognize that technological innovations do not succeed without changes in the social organization of their production and use. Second, since the service sector and product-service combinations have became economically important, the significance of service innovations with novel ways of doing things (rather than technological solutions) has correspondingly increased. Third, the aging of the Finnish population and the rising costs of health care call for innovative models of providing health and social services. Fourth, increased emphasis is placed on the significance of "social capital" (and communality or trust) for the innovativeness of a society. The idea of a human-faced competitive society leads to the idea of a "social innovation policy" (Hämäläinen & Heiskala 2004) that is capable of combining social equality, innovativeness and national competitiveness. The tendency of making the competitive society more humane is apparent in the report written by Pekka Himanen (2004) for the Finnish Parliament entitled *A Caring, Supportive and Creative Finland: A review of the profound challenges facing our knowledge society*. These redefinitions of the Finnish society and its innovation policy correspond to what Perez found essential in synergy phase: a focus on social and institutional innovations, support for the expansion of the new paradigm to the whole economy and to the daily lives of the people.[5]

However, Perez, Freeman and Louçã, have little to say about the contents of the organizational changes that take place during the deployment period of information technology. Freeman and Louçã (2002, 324–335) find that network is the organizational form of the information technological paradigm in contrast to hierarchy, the organizational form of the mass production paradigm. They discuss the concept of network firm and reflect in connection with Manuel Castell's (1996) idea of the network society, on the "spirit of informalism" and the possibility of self-regulating networks and decentralized participatory communication. In the regulatory regime they discuss the transition from the Keynesian "managed economy" that is characteristic of the mass production paradigm to the philosophy of free market in the last quarter of the 19th century. They conclude by suggesting that the influence of ICT will ultimately depend on social and political innovations. Perez (2002, 138–147) discusses first of all the financial innovations related to banking, financial services and accountancy. She

[5] Kettunen (2008, 170) finds that the term 'social' has a double meaning in the context of the "post-well-fare society" or competition society. On the one hand it refers to the social infrastructure of the competition society. Social is understood in reference to the production of "social and human capital." On the other hand, it is recognized that competition produces both winners and losers. In dealing with the latter group, 'social' is detached from its economic connection and is defined in terms of human dignity and from the point of view of preventing threats to the social order caused by marginalization.

does not deal very much with other organizational innovations of the post-bubble deployment period of the IT revolution. There is, however, plenty of research and theorizing on the organizational dimensions of the IT revolution. In the rest of this chapter, I will take a look at this theorizing and discuss four types of institutional changes.

3 NETWORKS, OPEN INNOVATION AND THE BREAKTHROUGH OF COMMONS-BASED PEER-PRODUCTION

There is growing agreement that the traditional forms of organizing economic activity, that is, markets and hierarchies, no longer meet the requirements of innovativeness after the onset of the information technological revolution. This is one manifestation of the Perezian mismatch. At least three complementary attempts to make sense of the emerging form of organization have been made: the concept of network (Håkanson & Snehota 1989, Powell 1990, Castells 1996, Von Hippel 2007), the concept of open innovation (Chesbrough 2003) and thirdly, the internet-mediated open source developmental model of software production. Many analysts think that the open source model is a pioneer example of the way innovation and production will be organized in the deployment period of the IT revolution. The open source model has been characterized in terms of collective invention (Nuvolari 2004), distributed creation (Boyle 2003), commons-based peer-production (Benkler 2006), and the democratization of innovation (V. Hippel 2005).[6]

The rapid development and specialization of science and technology and the increasing complexity of products have made it hard for a single organization to have the knowledge and resources needed in innovation or in production. Increased collaboration between firms, universities and research centres is needed. In innovation studies this development has been discussed in terms of networks of innovators (e.g. Freeman 1991, Rotwell 1992) and in organizational studies in terms of a network form of organization that is regarded as an alternative to markets and hierarchal forms. The open source developmental model, in turn, was related to two aspects of the ICT revolution: namely the radical decrease of the cost of producing and distributing knowledge as a result of digitalization and the new possibilities of organizing the innovation, production and consumption of knowledge via the Internet.

Many analysts (Powell 1990, Adler 2001, Freeman & Louçã 2002) think that markets and hierarchies are forms of organization that are characteristic of mass production paradigm and that the network is a novel form of economic organiza-

[6] There are other similar attempts, for instance the concept of co-configuration (Victor & Boynton 1998) or, which focuses on the importance of the collaboration between producer and user and therefore, has a family relationships to the idea of producer-user interaction in Lundvall's original NIS theory.

tion that is characteristic of the knowledge economy.[7] The difference between these three forms is usually drawn on the basis of their respective coordination mechanisms. In markets, it is price, in hierarchies, authority and in networks, trust. To be transferable in the market, knowledge must be explicated, packaged and priced. And when a transaction takes place, it flows mainly one way, from seller to buyer. The same applies to hierarchies, where standardized knowledge moves predominantly top-down from supervisors to subordinates and from planning departments to production units. Compared with these, the exchange in a network is based on reciprocal obligations and trust. It is also more informal, intensive and comprehensive (e.g., Powell 1990, Ebers 1999, Adler 2001) than in markets or hierarchies. Such qualities make networks suitable for the production and distribution of a complex knowledge with practical and tacit elements. As Powell (1990, 304) puts it, networks are

> "especially useful for the exchange of commodities whose value is not easily measured. Such qualitative matters as know-how, technological capability, a particular approach or style of production, a spirit of innovation or experimentation, or a philosophy of zero defects are very hard to place a price tag on".

When consolidated, network relations also foster the transformation of tacit knowledge into explicit knowledge thus accelerating knowledge production and transfer (Powell & Grodal 2005, 75). Thus, in producing and transferring complex, service-related and rapidly developing knowledge, networks outperform markets and hierarchies. Networks connect dispersed actors and the complementary resources needed for innovation (DeBresson & Amasse 1991). Networking is, therefore, a way to optimize the utilization of the available pool of resources both by expanding the number of potential partners and by better identifying the best of them for any given project (Benkler 2006).

A network's capacity to build channels for complex communication between diverse actors with complementary capabilities makes it "the locus of innovation." By bringing together dispersed knowledge, a network also opens up opportunities for a novel synthesis of the knowledge possessed by its members

[7] There are many theories of networks. Toikka & al. (2014) make a distinction between five concepts of networks: 1) general (Nohria 1992, Barabási 2002), 2) economic (Williamson 1993), 3) social (Granovetter 1985, Uzzi 1996), 4) economic (Powell 1990, Freeman 1991) and 5) objectual concepts (Miettinen & al. 2008) of network. Each of them has different understandings of the ontological, economic and historical nature of networks and they use different methods and data in studying them. Whereas the two first regard networks as the unhistorical foundation of all social and economic activity, the two latter think that network is a qualitatively new form of organization of economic activity caused by the scientific and technological revolutions and the development economy.

(Smith-Doerr & Powell 2005). This is one of the positive effects of networks. Information is enriched when circulated in a network; new connections and meanings are generated and older ones are further elaborated (Powell 1990, 304 and 324). Organizational forms are not pure in the real world. They can be mixed to create hybrid forms or they can be mutated. For example in the early phases of innovation product development, work is often based on the network collaboration of researchers and engineers with complementary expert knowledge and professional interests. When a product enters the market and the control of revenues becomes an issue, the intervention of hierarchical forms governance becomes more likely.

The "open innovation" has been used in two ways. In business studies Chesbrough (2003) introduced the term "open innovation" to refer an innovation strategy of firms based on an increased use of external resources and collaboration. This concept complements the ideas of the innovation network and a firm's network strategy (e.g. Cristenssen & al. 2005). It does not refer to Internet-mediated collaboration. Another way of speaking about open innovation is in the terms of the free and open source development model of software production (FOSS). FOSS has been regarded as a paradigmatic example of a network organization and distributed work characteristic of the information technological paradigm (Moon & Sproull 2002, Weber 2006, Von Hippel 2005, Benkler 2006).[8]

The development of the Linux kernel is perhaps the best-known example of this model. In October 1991, Linus Torvalds, a computer science student at the University of Helsinki, announced on the Internet that he had written "a free version of a minix-looklike for AT-386 computers," and he called on other hackers to participate in the modification and further development of the program code for their own use. Many accepted the invitation and an international distributed community of developers was formed. When the kernel grew to include millions of lines of code, Torvalds developed a modular architecture for it. A modular system minimized the need for communication between different

[8] Two competing terms have been used to refer to internet-mediated distributed software: *free* and *open* source software. *The Free Software Foundation* was established by Richard Stallman in 1984. It regards that any restrictions of the free distribution of software to be a restriction of the basic rights of software users in the information society. It therefore, condemns any attempts to exercise proprietary control of software (e.g. Berry 2004). In the opinion of the most of the visible open source developers (among them Linus Torvalds and Eric Raymond) Stallman's political programme alienates open source communities from the business sector. They launched the *Open Source Initiative* in 1998. The initiative underlines the benefits of the open development model compared to the proprietary and closed model (in which the source code is owned by a company) welcoming the collaboration between open source communities and the business sector. To include both camps and their ideologies into one term, FOSS (Free Open Source Software) was introduced in the 2000s.

components of the kernel and made it possible to write code parallel on different portions of the kernel (Moon & Sproull 2002, 387). “Trusted code writers” from the community were nominated as maintainers of the modules. They accepted the suggestions for new code related to the modules. The core of the community comprises Linus Torvalds and 121 maintainers. In addition, several thousand user-developers report bugs and the write new pieces of code (Lee & Cole 2003).

Emergent roles of Linux developers	**Number of contributors**	**Total number of e-mails sent to the mailing list -mails**
Core		
Project leader	1	2840
Maintainers	121	37387
Periphery		
Developers	2605	20563
Bug reporters	1562	4216

Table 1. The two-tier structure of the Linux community 1995–2000 (Lee & Cole 2003, 641)

The open source developmental model combines several institutional innovations. The free availability of code on the Internet, regulated by a new way of using IPRs (so-called copy left principle) is a precondition for distributed creation, which is a new way of organizing knowledge production. The open source development model also differs radically from hierarchical forms of organizing: the developers on the periphery select the problems and improvements they want to work with. Nobody gives orders.

The great advantage of the free source code (freely available on the Internet) is its usability. Access to source code makes it possible for users to change it to suit their specific needs. In the open developmental model, users (those able to write code) are developers who are motivated by the need to have a useful tool for themselves. In addition, a user can ask for instructions and advice from other users. Consequently, the more users a network has the more value it has for a user.

The open source development model was developed as an alternative to the closed, proprietary mode of software production exemplified by Microsoft. In the proprietary or closed mode, software is sold to the customer but the producer keeps the source code secret. The open source development model is also said to offer advantages over the closed, in-house model of software development (Moon & Sproull 2002). This has been explained by referring to the quantity and heterogeneity of the programmers and users involved in development. Eric Raymond (1999, 43), for example, has articulated the principle of the utilization of the localized variety or Delphi effect. Because “adding more users adds more different ways of stressing the program.” Each user “approaches the task of bug characterization with a slightly different perceptual set and analytical toolkit, a different angle on the problem.” The variety of skills, uses of software and the working environments of the volunteers, in addition to their sheer number, enhances the quality of a code (Von Hippel & Von Krogh 2003). The maxim "Given enough eyeballs, all bugs are shallow", dubbed "Linus's Law" by Eric Raymond (1999, 41) is the traditional explanation of the utility of the open source community. Goldman and Gabriel (2005, 27–28) refer both to the distributed expertise and to the privileged epistemic position of the users:

> “Regardless of how smart, creative, and innovative you believe your organization is, there are more smart, creative, and innovative people outside your organization than inside. In addition, the majority of those elsewhere doesn’t particularly care to make products in your space. But customers already using a product for real work are in a good position to offer suggestions about the directions in which that product should evolve.”

The emergence of the internet-mediated, open development model in software production has had at least three important consequences. First, it has extended knowledge production from software to other areas. Second, business firms have started to adopt the open source model as part of their strategy and production. Third, this model has stimulated a discussion of the nature and significance of the IPRs in knowledge production and innovation (Siltala & al. 2007).

In the 2000s the open source model has expanded to embrace the production of knowledge, services and even industrial activities. In the life sciences open access genome databases (e.g. the Cancer Genome Atlas) developed during 1990s and early 2000s into platforms of collaborative research. Researchers all over the world routinely use them. Another notable example of the open source model is Wikipedia, an encyclopaedia developed and maintained by users established in 2001. In 2003, the English Wikipedia included some 130,000 entries. By the end of the summer 2007 the number of entries reached the limit of two million. Wikipedia has many qualities that the traditional encyclopaedias lack: it is quickly and constantly updated, and recent review articles on the issue dealt with in an entry allow further reading and study. This remarkable knowledge medium was created outside the markets and it is a convincing demonstration of the strength of the open source model. It could not have been accomplished by any single organization or even a strategic alliance. According to the web pages of Wikipedia, 67,000 contributors have contributed to it. Especially the young generation has quickly adopted Wikipedia as a knowledge tool. In the slang of the Finnish youth the expression “look it up at Wikipedia” is as daily used as “google it.”

Inspired by Wikipedia and the gene databases, the Encyclopedia of Life (EOL) was started in February 2008. It is a free, online collaborative encyclopedia intended to document all of the 1.8 million species of living organisms known to science. It aims to assemble one "infinitely expandable" page for each species, including video, sound, images, graphics, as well as text. Experts and non-experts throughout the world compile it from existing databases and from contributions. It will incorporate the Biodiversity Heritage Library, which will contain the digitized print collections from the world's major natural history libraries. EOL differs from Wikipedia in that the major scientific institutions have been involved from the beginning.[9] A scientist (specialized in the species in question) will be selected as a curator of each species page. The homepage of the newborn encyclopedia characterizes its impact on science and society as follows:

> The Encyclopedia will serve as a truly global resource for information regarding life on this planet. Such a comprehensive resource of information has never been available to the scientific community or society at large. (…) Just as the biotechnology industry has been built upon the existence of large genomic sequence databases (such as GenBank), Encyclopedia of Life will have an equally catalytic effect on comparative biology, ecology, and related fields. (…)
>
> In addition EOL will also have significant social impact. EOL is making digitally available millions of pages of biological information previously only accessible in texts in a few institutions in the Northern Hemisphere. (…) The combination of access to primary texts and literature and the ability to use it freely allows unprecedented numbers of individuals the ability to participate locally in the global effort to catalogue new species and protect existing biodiversity.

[9] The project is initially backed by a $50 million funding commitment from the MacAthur Foundation and the Sloan Foundation. The steering committee includes senior individuals from Harvard University, Smithsonian Institute, the Field Museum, Marine Biological Laboratory, the Biodiversity Heritage Library Consortium and the Missouri Botanical Gardens and from the foundations that fund the enterprise.

In addition of being a universal asset of the biological sciences, EOL will be a powerful new means in education not because it is a new powerful source of knowledge and insight but because school classes will be able to contribute to it by submitting the results of their local studies. EOL will also available to anyone interested in nature. Anyone will be able to personalize information on the EOL website for their own interests and uses. The EOL web page supplies the following example. “One could create a field guide for a family vacation or for a day hike to a new location, which could then be downloaded to a personal digital assistant for easy access and information retrieval.”

Many researchers (Deibel 2006, Rai 2006, Weber 2006) thinks that the open source model will soon be adopted in the development of biomedical research because the present product system does not work well enough. It is too expensive, produces medicines primarily to markets with sufficient purchasing power and omits the medicines for the diseases that kill most people in the world. There are signs that the model is spreading to biomedical research. An example is the Synaptic Lead, “a network of online research communities that connect and enable open source biomedical research” founded in 2005. The communities involved (the malaria research community and the community for schistosomiasis) aim at developing proteins for medicines for “severely under-researched tropical diseases where the for-profit incentives are falling short.” The initiative wants to establish an alternative to the commercial development of pharmaceuticals.

It is also evident that network-based peer-to-peer support will be indispensable in the care of such national diseases as diabetes. In Finland 10 % of the adult population suffers from diabetes and has a constant need for consultation because of its various symptoms. Because this rapidly growing patient group will overload the health care system, “people with long-term conditions need help, advice, support and tools close to hand, without having to visit a doctor: that means more organized peer-to-peer support” (Leadbeater 2008, 151). An example of this support is the Internet pages of the diabetics of eastern-Helsinki, Finland. The network effect is visible in these pages: the more diabetics are involved in the network, the more likely an individual diabetic will find a solution to his problem. Chronic diabetics with years of experience constitute an indispensable knowledge resource. That is why this kind of community can complement the public health care system and perhaps also help in alleviating its escalating costs.

Leadbeater (2008, 132) supplies an illuminating example of open source business methods in the mining industry. Goldcorp, Inc., a Canadian mining company decided to post all the company’s proprietary data – 50 years’ worth of surveys, maps and geologists’ reports – on the Internet to see whether the global community of geologists could locate gold reserves. A prize of $500,000 was promised for suggestions that led to mining. The invitation attracted 140 submissions. Half of the winning suggestions identified drilling sites that had not been spotted before by the company. According to Leadbeater this case shows that the open source approach can also be applied to basic industries and manufacturing. Von Hippel (2005) reports how user communities collaborate on the Internet to design such outdoor recreation as mountains bikes and gliders. In recent years, IT firms have started to utilize the open development model either by releasing their source code to potential contributing users or by joining open source development projects.

The open development model and its copy-left principle have caused an intensive discussion of the legal foundations of knowledge production. The development model has been compared both to open science and to the recent open access movement. According to the traditional view, the cumulative development of science is based on universal access to knowledge, also dubbed – paraphrasing Newton – the "standing on the shoulders of giants" effect. The open access movement finds it objectionable that publishing companies obtain copyright to scientific papers written, evaluated and edited by academic scientists salaried by public funding (e.g. Willinsky 2006). Primarily universities and libraries then subscribe to the journals in order to make them accessible to scientific communities. This state of affairs was based on the printing and distribution costs preceding the Internet age. Since these costs have been reduced as result of digital technology and the Internet now supplies a strong channel of distribution, the open access movement wants to advance access to scientific new knowledge by developing electronic publishing.

4 INTELLECTUAL PROPERTY RIGHTS AND THE INTERNAL CONTRADICTION OF THE KNOWLEDGE SOCIETY

> It is widely agreed that knowledge, high technologies and innovation have become decisive factors in the economic competition between firms, nations and international alliances. A valuable asset must be controlled in order to take full advantage of it. It is no wonder that two well-known proponents of the so-called "enterprise university" have suggested that the capitalization of science by transforming scientific knowledge into economic goods "is a fundamental social innovation" (Etzkowitz & Webster 1995, 482).

Etzkowitz and Webster (1995, 483–485) have identified three steps in the capitalization of knowledge: 1) To secure knowledge as private property by patents and copyrights, 2) to accrue the value from knowledge secured typically through marketing and licensing activities, 3) to renew and increase the value of knowledge by linking public sector science and industry activities to each other. In contrast to this position, knowledge is regarded by others as a paradigmatic example of a "public good" inasmuch as its availability to one consumer is not diminished by its use by another. Knowledge is therefore not suitable at all for exchange in markets, where scarcity is the premise. Some economists as well as students of science and property rights see here the central emerging contradiction of high technology capitalism. Gernot Böhme (1998, 461), a historian of science, defines the contradiction between commoditization and open, critical science as follows: "Knowledge society incorporates the internal contradiction between knowledge, which as cultural capital is common property, and the knowledge economy, which is based on the privatization of knowledge." Paul Adler and Charles Heckscher (2006, 29) characterize this contradiction as follows:

> A substantial body of modern economic theory has shown that the market mechanism fails to optimize the production and distribution of knowledge. (…) With knowledge, as with other public goods, reliance on market/price mechanisms forces a trade-off between production and distribution. On the one hand, production of new knowledge would be optimized by establishing intellectual property rights that create incentives to generate knowledge. On the other hand, not only are such rights difficult to enforce, but, more fundamentally they block socially optimal distribution.

> Distribution of knowledge would be optimized by allowing free access because the marginal cost of supplying another consumer with the same knowledge is close to zero.

In analyzing the breakthrough of the open source development model in software production and the public-good quality of information on the Internet, business economists Bruce Kogut and Anca Metiu (2001, 250–251) present two hypothesis: 1) secrecy and intellectual property rights create incentives that lead to behaviours that render economic activity less efficient, 2) the open source production model is more efficient than in-house hierarchical models.

Some scholars state that the increasing private ownership of knowledge already limits communication between researchers, the availability of new knowledge and, therefore, innovative activity (Heller & Eisenberg, 1998, Nelson 2001, Rai & Eisenberg 2003). They think that the culturally cumulative nature of knowledge, the extensive use of prior cultural resources, imitation and the combination of the ingredients of culture in creative work (or "standing on the shoulders of giants" effect) demands a strong public domain that is able to keep knowledge freely available (Benkler 2006, Cohen 2006).

James Boyle characterizes the expansion of the private intellectual property rights at the cost of the public domain as "the second enclosure movement." The first enclosure movement refers to the process of fencing off common land and turn it into private property in England.[10] He finds this development to be in contradiction not only with the shared and culturally accumulating nature of knowledge development but also with the Western legal tradition. Many of the social theorists of the 18th and the 19th century regarded the publicity and freedom of knowledge as an important principle and had a negative attitude towards its private ownership. In commenting on the US patent law of 1814 Thomas Jefferson regarded it as a deviation from natural rights and doubted that the monopoly of ideas would cause negative social consequences. Boyle (2003, 38-39) crystallizes the tradition by citing a legal scholar from the year 1918: "The general rule of law is, that the noblest human productions – knowledge, truths ascertained, conceptions, and ideas – become, after voluntary communication to others, free as the air to common use."

The discussion of the effects of the Bayh-Dole Act of 1980 raised the concern of the negative effects of exclusive property rights on innovation. The law was passed to stimulate the commercialization of university research results. It was based on the rationale that firms would not invest in the development of

[10] Boule (2003, 34) points out that what he refers as to "the enclosure movement" was actually a series of enclosers that started in the fifteenth century continued, by different means and varieties of state interventions until the nineteenth century.

research results into products, unless they obtained exclusive property rights to the research results. In an extensive discussion on the effects of the Bayh-Dole Act (Nelson 2001, Hendersson & al. 2002, Mowery & al., 2004) this rationale was questioned, and need for a variety of ways of technology transfer, including forms of unofficial collaboration between universities and industry was underlined. It has been argued that patents and their licensing to one or more actors, excluding use and experimentation by many others, may inhibit the development of knowledge and technology. ”In particular, restrictive licensing may excessively limit the diversity of further experimentation and development in a context when multiple, rivalrous development efforts may be more socially desirable” (Mowery & al. 2004, 191). The granting of exclusive property rights together with the inclusion of new kinds of patentable entities tends to limit the innovation and the further development of knowledge by actors in numerous different contexts.

Paul David and Dominique Foray (2002, 18) suggest that knowledge develops when it moves from one place another. While moving, it is enriched, commented upon and recombined by others. The new discoveries are metaphorically an outcome of “unplanned journeys through information space.” They conclude (ibid., 19): ”If that space is restricted by a host of property rights, then the journey will become expensive (if not impossible) and the knowledge base itself will suddenly be shrinking.”

A reverse development, a programme to keep knowledge freely available and modifiable, emerged in software production. The tension-laden duality between proprietary and open source forms of development was present in the development of the Unix operation system. Dennis Ritchie and Ken Thompson in the AT&T Bell Laboratories originally developed it in 1969. Because AT&T was not allowed to extend its activity to software business, they licensed it at a nominal price to universities (Moody 2001). Traditions of free exchange and distributed incremental development of software developed in the networks of universities and firms. At the end of the 1970s the Berkley Software Distribution network distributed Unix free of charge to anybody who wanted it. When the commercial value of Unix became evident AT&T brought a suit against the Berkley network demanding Unix’s return. However, the network had rewritten the original code during the trial and the foundation of the suit was removed.

The software business emerged in the 1970s, and Microsoft was established in 1975. As a counterbalance to the proprietary software production, Richard Stallman, programmer at MIT, founded the Free Software Foundation in 1984 and formulated a new type of licence, the *General Public Licence* (GPL), based on the copy left principle. This licence allows users to use, modify and further distribute code freely. Stallman (2002, 20) explains the idea of copy left as follows:

> So we needed to use distribution terms that would prevent GNU software from being turned into proprietary software. The method we used is called *copy left*. Copy left uses copyright law, but flips it over to serve the opposite of its usual purpose. Instead of a means of privatizing software, it becomes a means of keeping software free. The central idea of copy left is that we give everyone permission to run the program, modify the program and, and distribute the modified versions – but not permission to add restrictions of their own.

Stallman articulated two foundations for the copy left principle. First, as a result of the digitalization and the emergence of the Internet, the cost and time of reproducing and transmitting knowledge had decreased to almost zero. The second foundation is the incompatibility of patents with the incremental, distributed and shared nature of software design. Stallman explains (Stallman 2002, 105): "When you write a program, you are using lots of different ideas, any one of them might be patented by somebody (…). So there are possibly thousands of things (…) in your program, which might be patented by somebody else already. This is why software patents tend to obstruct the progress of software – the work of software development." Stallman thus challenged the prevailing institutions of intellectual property rights by referring to economic reasons (the cost of the reproduction and transmission of digital products), to the rights of users in an information society, as well as to the use-value demands of software production, that is, the transferability of the software to meet the needs of the user.

In *Democratizing Innovation*, Eric von Hippel (2005) suggests that the open source model anticipates and expresses an ongoing development towards user-community-based innovation. The emergence of the Internet and new tools based on information technology, such as CAD (computer-aided design), databases and platforms, have made this development possible. The heterogeneous needs and capabilities of users can be mobilized to contribute to the design of new products. According to von Hippel, firms will increasingly externalize the development of ideas and prototypes to user communities, and appropriate the results in their business without owning them. Red Hat, the vendor of Linux distributions, is a successful example of this business model.

Many analysts suggest that the open source model has led us to acknowledge that there are different ways of knowledge production with corresponding legal regimes. Yochai Benkler (2006, 43) at Yale University has presented a framework for analyzing this diversity. He makes a distinction between nine strategies of information production. The main distinction between three groups of strategies is based on different legal-economic foundations: 1) operating in the market based on exclusive property rights (with patents), 2) operating in the market not based on exclusive rights (e.g. scholarly services, business based on hard-to-imitate expertise, learning networks), 3) operating in the public domain not based on exclusive rights (academic research, military research, open source and other models of knowledge sharing). Benkler points out that the model of innovation based on exclusive property rights and markets – dominant in the prevailing innovation policy thought – is, even historically, only one model among others.

Most of the knowledge production after the Second World War took place outside the market and sphere of property rights. In the USA secret public research ("Los Alamos research") dominated knowledge production. As late as 1985, 65 % of the public research funding of the United States was directed to military research (Grove 1989, 69). The foundations of the information technological revolution emerged from research done with funding allocated to military budgets. Mathematical information theory, cybernetics, computers and network emerged as part of developing defence systems (e.g. Edwards 1996).[11] Equally, the war against cancer conducted by the National Institutes of Health of United States played an important role in funding the research that led to the emergence of molecular biology (e.g. Fujimura 1996). Without doubt publicly funded research will play an essential role in solving the vital problems of today, including climate change, environmental degradation and energy.

Benkler thinks that forms of production based on publicly available knowledge are increasing. Benkler calls this "commons-based peer-production." The first part of the term (commons-based) refers to the fact that in this production no individual person (for example the patent holder) can determine who is allowed to use the knowledge. Instead the use must be unlimited or take place according to the agreed rules (as in copyleft licensing). The second part of the term (peer-production) indicates that each of the participants decides whether and how she or he will contribute to the production. The contributors do not follow any centralized plan, rules or orders, contrary to how work is organized hierarchical organizations.

It is evident that intellectual property rights is a domain that will be transformed to conform to the requirements and possibilities of information technologies. Economists of innovations have mainly analyzed IPRs as incentives for innovation and economic activity. Legal scholars look at them from the point of view of the obligations and rights of people (Hilgartner 2002). Both aspects need

[11] S Boutillier (2005, 66) points the US post-war military programmes as a cradle of the modern ICT-based financial capitalism: "The new information and communication technologies generated by military programs represent new investment possibilities. Therefore, it is necessary to release the capital which has been raised by nationalizations. This is done by the financial revolution."

to be reconsidered. The innovations made by user communities cannot be explained by economic incentives alone. Our understanding of the motives of creative work requires revision.[12] The extension of property rights to genes and cells gave rise to contradictions between private and public interests in the 1990s. The public debates related to these contradictions are already leading to reinterpretations of patent practices and international agreements.

The owner of the US patent for the breast-cancer genes, Myriad Genetics Inc., demanded in 1998 that the British National Health Organization stop using the diagnostics based on these genes in their regional preventive screening programme. A requirement to send the samples to Myriad Genetics lab in the USA would have collapsed the screening system based the evaluation of risk and not on the solvency of the patients. These demands were opposed by the British health authorities, researchers and patients (Parthasarathy 2005; 2007; Orsi & Coriat 2005). Another example is related to AIDS (Drahos & Braithwaite 2002). In 1997, the United States, the EU, and a group 41 medical companies demanded that the South African government and President Mandela repeal the law that allowed the use of cheap substitute AIDS medicines in South Africa. They appealed to the TRIPS treaty (The Agreement on Trade-Related Aspects of Intellectual Property Rights), according to which the use of these medicines violate the rights of the original developers of the medicines. In 2001 the WTO recognized the rights of nations to protect the health of their citizens.

The diversification in the use of property rights has been taking place for two decades in biotechnology and in software production. A recent characterization of the development in software production summarizes the situations as follows (Deek & McHugh 2008, 326):

> The different modes of production that have already evolved seem likely to persist: open, proprietary, and hybrid combinations. Pure open source and proprietary modes will grow, each dominant in certain market areas. Hybrid modes of cooperative development will be increasingly widely used. While some existing proprietary systems will see their markets overtaken by open source replacement, other proprietary applications, as well as mixed modes of commercial development, can be expected to flourish.

[12] Research in philosophical anthropology (Honneth, 1996, Taylor 1991) as well as social (Mead 1934, Allport 1961) and cultural psychology (Miettinen 2006) suggests that, because of the social origins of human mind and motives, a basic incentive for creativity and innovation lies in the *need to be recognized* by the community and culture to which an individual belongs. This has also been analyzed in terms of gift economy and altruism based on the shared membership in communities that sustain reciprocity and identity (e.g. Kogut & Metiu 2001). This is why people innovate and contribute without strong economic incentives.

Different views of the future development have been presented. Some researchers, like Deek and McHugh above, think that the forms will co-exist and that the most interesting development will be in the creative middle ground "where new hybrids will appear, mixing open and closed, public and private, community and corporation, collaboration and commerce" (Leadbeater 2008, 128). Other researchers find the development more contradictory (e.g. Lester & Piore 2004). They remind us that the agents of the commons-based models are movements that reacted to the market failures in different areas of economic and social life: these movements have agendas and ideologies. The free open source movement emerged as a reaction to "closed," proprietary software production and as a reaction to the inability of the prevailing IPR regime to support the creative use of computers and the Internet (Berry 2004). The open access movement emerged as a reaction to the rising prices of the scientific journals, which effectively prevented the access of researchers in the poorest countries to the journals and made access more difficult even in universities in industrialized countries. People involved in the Synaptic Lead cannot accept that pharmaceutical companies do not develop medicines for the tropical diseases that kill the largest numbers of people.

Nick Dyer-Whiteford (2007) argues that the commons-based forms of production contradict and challenge the commodity-based production characteristic of capitalism. If the cell form of capitalism is the commodity, the cellular form of a society beyond capital is the common (2007, 82):

> A commodity is a good produced for sale, a common is a good produced, or conserved, to be shared. The notion of a commodity, a good produced for sale, presupposes private owners between whom this exchange occurs. The notion of a common presupposes collectivities – associations and assembles – within which sharing is organized. If capitalism presents itself as an immense heap of commodities, 'commonism' is a multiplication of commons.

Commons refer to the possibility of collective rather than private ownership in three key domains of life: ecological commons (water, atmosphere, fisheries), social commons (public provision of welfare, and health, education, etc.) and networked commons (e.g. access to mass communication). Market failures are deepening on all these three domains: the ecological crisis, global inequalities and the inability of capital to utilize new technological resources efficiently and equitably. Computers and networks have made rapid and inexpensive communication and knowledge possible. These are increasingly emerging outside the market and are best utilized by commons-based communities.

The market failures in these three domains illustrate the failures of the commodity regime. In each, new forms of commons will be developed in reaction to the market failures. In addition they will also be interconnected (Dyer-Whiteford 2007, 85) “A publicly funded education institution (social common) produces software and networks that are available to an open source community (social common) which creates a software used by an agricultural cooperative to track its use of water and electricity (ecological common).” Dyer-Whiteford (1999, 4) characterizes the competition between the proprietary and commons-based as a “contest for general intellect”.

No matter how the regimes of knowledge production develop, the idea that the firm is the heart of the innovation system will not be a sufficient starting point for innovation policy. Innovation policy has to reconsider how to take into account commons-based knowledge production as well as the innovations by user communities and hybrid communities. Socially important innovations by user communities, such as web pages for diabetics, merit support through public funding, for instance in the form of professional software expertise in developing and maintaining web pages.

5 INNOVATIONS AND DEMOCRACY: FROM TOP-DOWN POLICIES TO LOCAL EXPERIMENTS AND INSTITUTIONAL LEARNING

The synergy phase in the information technological revolution also calls for transformation of the innovation policy practices. Technology policy practices have not been discussed thus far from the point of view of the dynamics of the technological revolution. The traditional set of instruments, such as increasing R&D funding, program writing, technology forecasting, technology programmes that require collaboration between firms and universities and other ways of directing research and development were largely created to recognize the new promising technologies and nurture industrial activities based on them. The innovation system policy of the 1990s introduced a set of measures targeted to increase the interaction between the institutions and activities relevant to innovation, above all between publicly funded research and firms. It also strengthened the attempts to create “regional systems” of expertise and, “centres of excellence” based on nationally strategic areas of technology.

None of these measures seemed to address the central challenge of the synergy phase of the IT revolution: how to bring about social and institutional changes that allow the full deployment of the possibilities of information technologies in society. For the most part, these measures have had a top-down nature, coming primarily from think thanks, task forces of specialists, innovation researchers and civil servants of ministries and funding institutions. They have had difficulties in dealing with specificities of reorganizing activities in different aspects of social life. The organizational changes called for in the synergy phase are realized on a local level in the organization of work and in daily personal interaction.

In the Finnish innovation policy discourse in the early 2000s this subject was discussed in terms of the specificity of “social innovation policy” compared with the previous technology-centred innovation policy. A social innovation policy focused on social innovations defined as “reforms related to regulation, politics, organizational structures and models of action that improve the performance of society” (Hämäläinen & Heiskala 2004, 10). Hämäläinen and Heiskala find ”strategic visioning on national, sectoral and regional levels” to be the primary means of implementing a social innovation policy. They (2004, 122) propose a strategic forecasting and evaluation system. Strategic visioning or “management by vision” requires an establishment of a centre that is in charge of the coordination of visioning and of the accumulation of knowledge on forecasting and evaluation. On the basis of such a system of visioning, experiments in different sectors of society can then be launched (ibid. 153).

This suggestion stands in the tradition of policymaking from the top down. I think that the challenges of the synergy phase require that the locus of policymaking should be shifted to local experimentation. Strategic visioning is inefficient because the programmatic documents that it produces are less likely to lead to new ways of acting in firms or in public services. The challenges of innovation in different activities, say, in nanotechnology as opposed to music education are so different and domain-specific, that the best solution is address them directly to professionals working in the respective organizations. In other words, the task of innovating should be delegated directly to the local level, to the experts who know their field, its problems and conditions best.

Evidence is mounting that it is difficult to introduce service and organizational innovations by centralized measures and projects without the strong involvement of local practitioners and clients. For instance, even ambitious and well-resourced national or regional programmes in Finland in the field of social and health services have had difficulties in making changes in their activities on the local level or in the lives of their clients (e.g. Ohtonen 2002, Hyppönen 2004). A recent study of publicly funded regional centres of expertise in social services in Finland summarizes its results as follows (Kaakinen 2007, 44):

> The stories told by social service managers in small municipalities regarding the usefulness and success of the projects are blunt. There are lots of projects and meetings, papers are produced, but the amount of wasted time and the number of unsuccessful projects is high in relation to the achievements. And even if a project is successful, the work is stopped in the implementation phase at the latest because of the lack of resources (...) The projects cover the most important areas of social service, but the mix of projects is messy. Breakthroughs or actual changes in the ways of doing things are rare and require long-term efforts as a part of normal office work rather than mostly short-lived projects.

A forum on the future of the care of elderly Finns in October 2007 concluded that local inventions and insights do not transfer well from one place to another. According to a distinguished senior scientist in the field: ”We have lot of projects in this country but their results do not spread.”[13] He suggested that a shared register of projects and local models might help the municipalities find out what has been achieved elsewhere and avoid duplication. Such a register could func-

[13] Professor Pelkonen, Helsingin sanomat 31.10.2007.

tion as a means of learning and comparisons. The main limitation of the suggestion is evident: a register alone does not suffice. Descriptions and analyses of the local models are needed to make their application and further development elsewhere possible. These results suggest that the emphasis of innovation policy should be shifted to local experiments in different sectors of society.

John Dewey developed the idea of social experimentation as a key mechanism of democracy, social learning and innovation. Students of public administration and policy have recently rediscovered the relevance of Dewey's approach (Evans 2000, Snider 2000, Shields 2003). As a model of participatory democracy and bottom-up policymaking, it seems to supply answers to the problems caused by managerialism and top-down policymaking dominated by specialists. The attractiveness of Dewey's approach is that it connects democracy to the development of the capacities of individuals, and to the solving the social problems by experimentation and to the formation of what he called communities of inquiry.

Dewey found that democracy is related to the relationship between the individual, the community and the state. As psychology (Wertsch 1985, Bakhurst & Sypnowich 1995, Tomasello 1999) and sociology (Burkitt 1991) widely do today, and as his colleague and fellow pragmatist John Herbert Mead (1934) did, Dewey recognized the social origins of the human mind and its capabilities. That is why he sees that the positive rights of individuals to develop their capabilities depend on how work, community life and the state are organized. For Dewey, democracy was connected to ”the concept of equality defined as a freedom generated by the society for individuals to develop fully the potential each has for the common life of all” (Evans 2000, 312). From the point of view of innovation, the relationship between the individual and community development is reciprocal: the creative work in communities of inquirers supplies an environment conducive to maximum individual development.

The second element in Dewey's theory of politics and democracy is his logic and his concept of inquiry (Dewey 1938/1991). In Dewey's theory of experience, knowledge is achieved by practically interacting with and transforming the social and physical environment. Dewey's logic is consequently logic of both inquiry and transformation or reconstruction of social practices and the world (Campbell 1992, Burke 1994). When established ways of action do not work or a social problem is faced, reflection on the conditions of the action is needed. A working hypothesis is formulated to change a situation and to find a solution. Efforts to implement the solution in practice finally test the viability of the working hypothesis, and the success of this experiment is evaluated. The pragmatist political philosopher Cornel West (1989, 86) finds that in Dewey's approach "a subtle and nuanced grasp of critical intelligence, and a profound commitment to the expansion creative democracy" are inseparably intertwined.[14]

Dewey's logic is based on a number of assumptions concerning the nature of reality, knowledge and the ethos of social inquiry (for reviews see e.g. Bernstein 1992, Garrison 2000). First, contingency and change are pervasive features of the universe. "For a pragmatist, contingency and chance is not merely a sign of human ignorance, they are ineradicable and pervasive features of universe" (Bernstein 1992, 329). Second, knowledge is fallible and provisional. Third, the attitude of pragmatist studies of society is that of fecund criticism (Zanetti & Carr 2000) or critical optimism (Shields 2003), "the belief that the conditions which exist at any moment, be they comparatively bad, or comparatively good, can be bettered (Dewey 1920/1957, 178)." This attitude tries to avoid the extremes of condemning the existing order or of endorsing an ideal state of affairs. It finds that both of these positions are detached from practice and suggests experimentation, practical transformation of reality as a solution. Dewey derives the principle of critical optimism or meliorism in the following way (1920/1957 177):

> "The process of growth, of improvement and progress, rather than a static outcome and result, becomes the significant thing. Not health as a fixed once and for all, but the needed improvement of health–a continual process–is the end and good. The end is no longer a terminus or limit to be reached. It is the active process of transforming the existent situation. Not perfection as a final goal, but an ever-enduring process of perfection, maturing, refining in the aim of living. Honesty, industry, temperance, justice, like health, wealth and learning, are not goods to be possessed as they would be if they expressed fixed ends to be attained. They are directions of change in the quality of experience. Growth itself is the only moral 'end.'"

In his book *School and Society* (1899/1976, 56), in which he presents the principles of his Chicago experimental school, Dewey wrote that the purpose of social experiments is that "other people need not to experiment; or not need to experiment so much" and "may have something definite and positive go by." A social experiment produces working models that can be further adapted and developed in other localities.

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[14] Cornel West (1989, 214) has developed the theoretical foundations of an approach that he calls "emancipatory social experimentalism" based on the "ideals of creative democracy and individuality." West is also indebted to Ralph Waldo Emerson, Antonio Gramchi, C. Wright Mills and Roberto Unger.

Dewey's logic is a way of solving social problems and a way social learning. The agent of problem solving is a community of inquiry or an experimental community (e.g. Shields 2003). This community is, as it would be put today, a heterogeneous or hybrid community. It is composed of managers, specialists, employees and social scientists. But a community of inquiry is also a democratic community in which the voice of no one of these groups alone dominates. Dewey was wary of the dominance of specialists because it tends to exclude the points of view of the people who are directly involved and influenced by as social problem. He (see Evans 2000, 319) also called for a "well educated democratic community" that has the capacity to control the technology and to use it to enhance the life of all.

As a matter of fact, in today's developed societies, in which the level of education is high, the division between experts and non-experts is problematic. For instance in Finland, the 70 % of the age cohort in the 2000s pursue higher education. 58 % of them attend universities and 42 % attend polytechnics. A rich pool of scientific and vocational expertise will be distributed across the fabric of society. In addition, several studies on concrete decision making situations and projects have uncovered the limitations of expert knowledge and the virtues of "lay knowledge" (e.g. Brown 1992, Kleinman 2005, Wynne 1996, Yarley 2000). Instead of experts and non-experts, we will rather have different kinds of specialized expertise – theoretical and practical – that are needed to mobilize dialogue in the cooperative process of social inquiry. In collaborative experiments, the professional employees in different fields: teachers, engineers, social workers etc., play key roles.

Social scientists have a special role in social experiments. Those who are in charge of conducting them do not have any opportunities to collect data during the course of the experiment or analyze its effects. Since learning from the experiments and transferring that knowledge to other places requires a systematic account of an experiment and analysis of the results, social scientists are needed.[15] In *Public and Its Problems* Dewey (1925/1988, 362) characterizes the role of social science within the social experimental thinking as follows:

> Policies and proposals for social action should be treated as working hypotheses, not as programs to be rigidly adhered to and executed. They will be experimental in the sense that they will be entertained subject to constant and well-equipped observation of the consequences they entail

[15]In commenting on the social experiment of the Chicago School of Sociology, Gross and Krohn express this as follows (2005, 78): "There can be no experimental practice without its reflective description as experiment in terms of design, data collection and interpretations of effects. In this sense the sociologists attempt to inform society how to learn by experimenting."

> when acted upon, and subject to ready and flexible revision in the light of observed consequences.
>
> The social sciences, if these two stipulations are fulfilled, will then be an apparatus for conducting investigation, and for recording and interpreting (organizing) its results. The apparatus will no longer be taken to be itself knowledge, but will be seen to be intellectual means of making discoveries of phenomena having social import and understanding their meaning.

Michael Dorf and Charles Sabel (1998) have developed a pragmatist concept of democracy that they call democratic experimentalism. In it (1998: 267) "power is decentralized to enable citizens and other actors to utilize their local knowledge to fit solutions to their individual circumstances, but in which regional and national coordinating bodies require actors to share their knowledge with others facing similar problems." I have regarded this approach as promising way of developing services in an enabling welfare state compared to top-down development and the idea of evidence-based best practices (Miettinen 2013). A key question for institutional learning is, how the process and results of local experiments are articulated and generalized in a way that allows cumulative learning.

In social, educational and organizational studies, experimental or interventionist approaches have been studied to stimulate local organizational change (e.g. Cobb & al. 2003, Engeström 2005, Flyberg 2001). An example of such an approach is the Change Laboratory method developed in the Center of Activity Theory and Developmental Work Research of the University of Helsinki (Virkkunen & Newman 2013). In applying it to the study of the development of home care for the elderly in the City of Helsinki, Engeström and his colleagues (2007) speak – instead of best practices – about cultivating promising practices into social innovations and attempts to distribute them systematically. The goal of the three year project is (2007, 3) ”to recognize, cultivate and link the new promising practices of the home care of elderly in the City of Helsinki and develop them further on into largely usable models of home care in Helsinki." Managements, planners, foremen, social workers, home care providers, nurses together with researchers and doctoral students constitute a community of inquiry or, it may more opportune to say, a community for the development of new practices.[16]

The local experiments cannot be initiated nor can they survive on a large scale unless they are recognized and supported by management systems. Local

[16] Examples of interventions to foster social innovations see Engeström & al. 2003, Hasu & Miettinen 2006, Miettinen & Virkkunen 2005.

experimenters are often pioneers who use a lot of extra time to construct and develop new ways of doing things. Unless they receive recognition and support, unless they are freed from the restricting rules and conditions at every turn, they become tired and their attempts to develop new solutions will lose vitality and wither away. For this reason, it is an essential to study management practices to see whether they support or hinder local experimentation.

In a book entitled *The Future of Management* (2007) Gary Hamel deals with the same problem in the management of business firms. According to him, the main idea of the prevailing paradigm of business management is the achievement of efficiency through planning, control and evaluation (2007, 8): "The machinery of modern management gets fractious, opinionated, and free-spirited human beings to conform to standards and rules, but in so doing it squanders prodigious quantities of human imagination and initiative." The employers are not supposed to innovate and there are no incentives, means or time for creative innovations.

According to Hamel this paradigm of has come to the end of its journey and a transition is already taking place. A well-known example of this transition is Toyota, which expect its workers to make suggestions for improvements in production. ”For more than 30 years, Toyota's capacity for continuous improvement has been powered by a belief in the ability of 'ordinary' employers to solve complex problems." In 2005 the company received more than 540,000 suggestions for improvements from Japanese employees. Google allows its employers to use 20 % of their work time for their own projects, and this procedure has already produced new products, among them Google's Chat service. Hamel asks how the time and space for grassroots innovation can be created in an organization that is running flat out to deliver today's results?

A contradiction or a paradox of innovation policy in the synergy phase of the information technological revolution can be formulated. At the same time that innovation policy proclaims the transition to the knowledge society and the need for social and institutional innovations, management methods and forms of governance that originate in the mass production paradigm continue to be implemented. These methods, with their focus on efficiency by controlling the achievement of standard outcomes defined by indicators, render experimentation and the creation of new ways of action ever more difficult if not impossible. It is hard to understand how innovativeness in a society of well-educated citizens could be based on other grounds than trust, that is, on a form of governance in which people are given the possibility to use and develop their talents by participating to innovative activity.

Consequently a reform of the methods of governance is needed in which management by rules and by results is replaced or complemented with forms of management that promote local experiments. To use Dewey's terms: the formation of communities of inquiry that carry out social experiments and articulate the results of these experiments within the society are needed. In such a system, innovative experiments are expected from local organizations. They are recognized and rewarded and their results are distributed by communities of inquiry that report, analyze and articulate the new models and their results.

This is one of the institutional transformations that the information technological revolution entails. Such a system of governance would also mean increased participation of professional and employees in all spheres of society to innovative social experiments. According to this view, which resembles the outlook of Dewey's critical optimism, the goals of enlarging democracy, developing of individuals' capabilities, and improving the quality of working life is potentially conducive to successful innovating. This can be achieved only if the forms of governance are transformed to encourage for public participation and the formation of communities of inquiry in all spheres of society.

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